Nikon

PROFILE PROJECTOR MODEL 6C

Instructions

MP MASTER
MA29620

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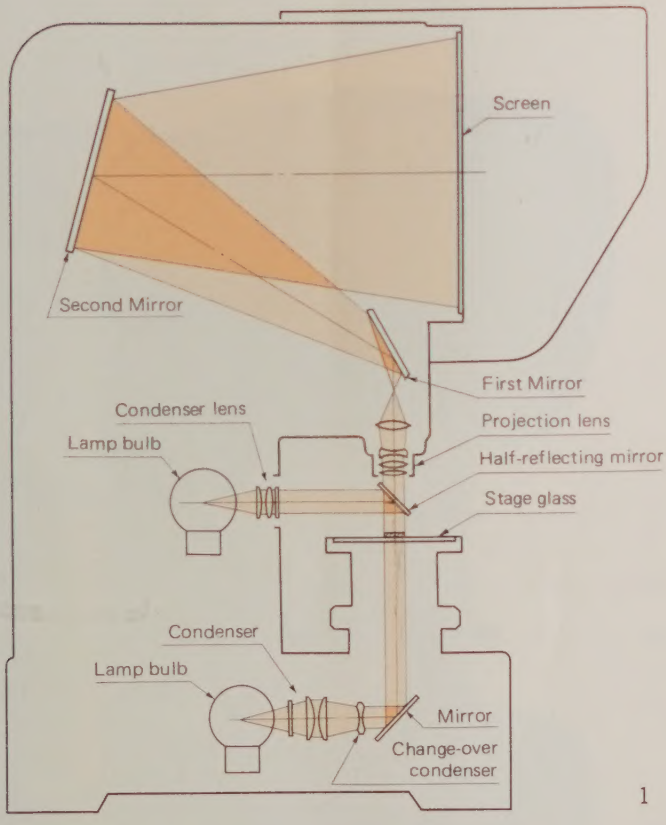
Optical System of Profile Projector Model 6C



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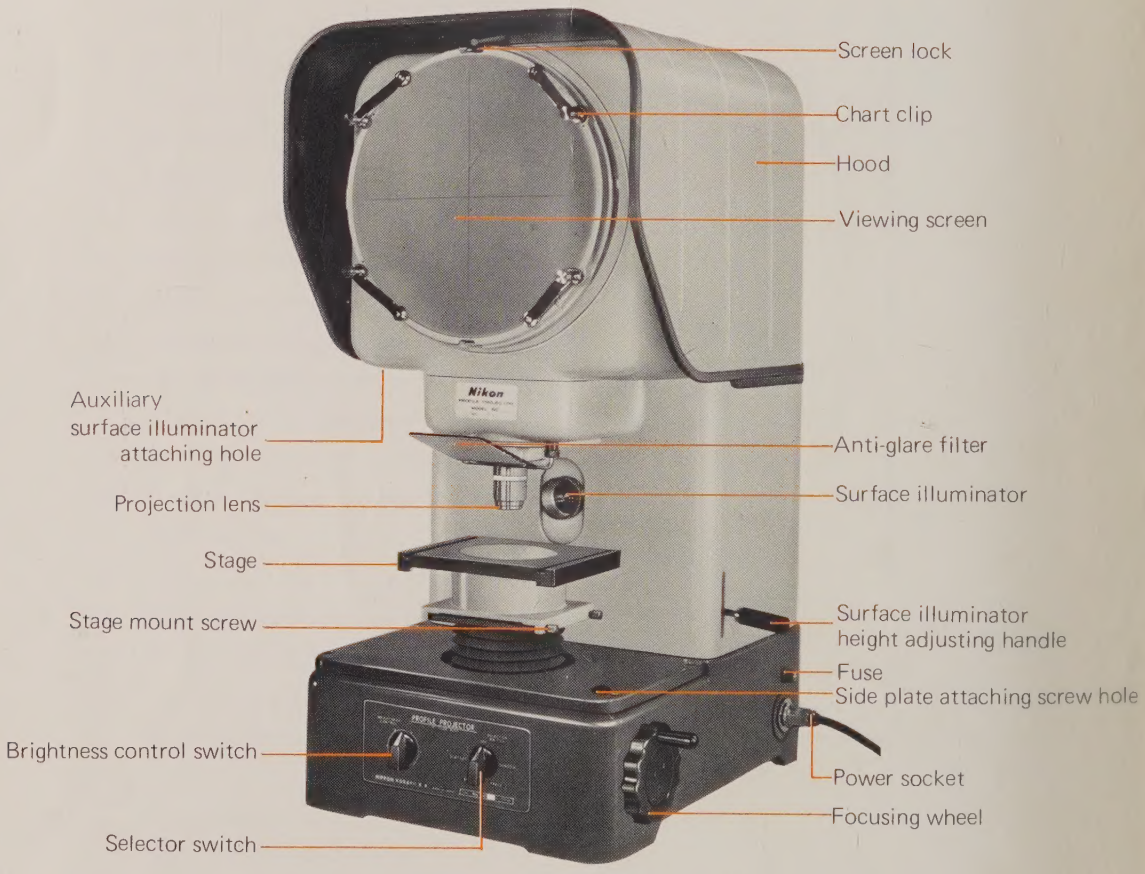
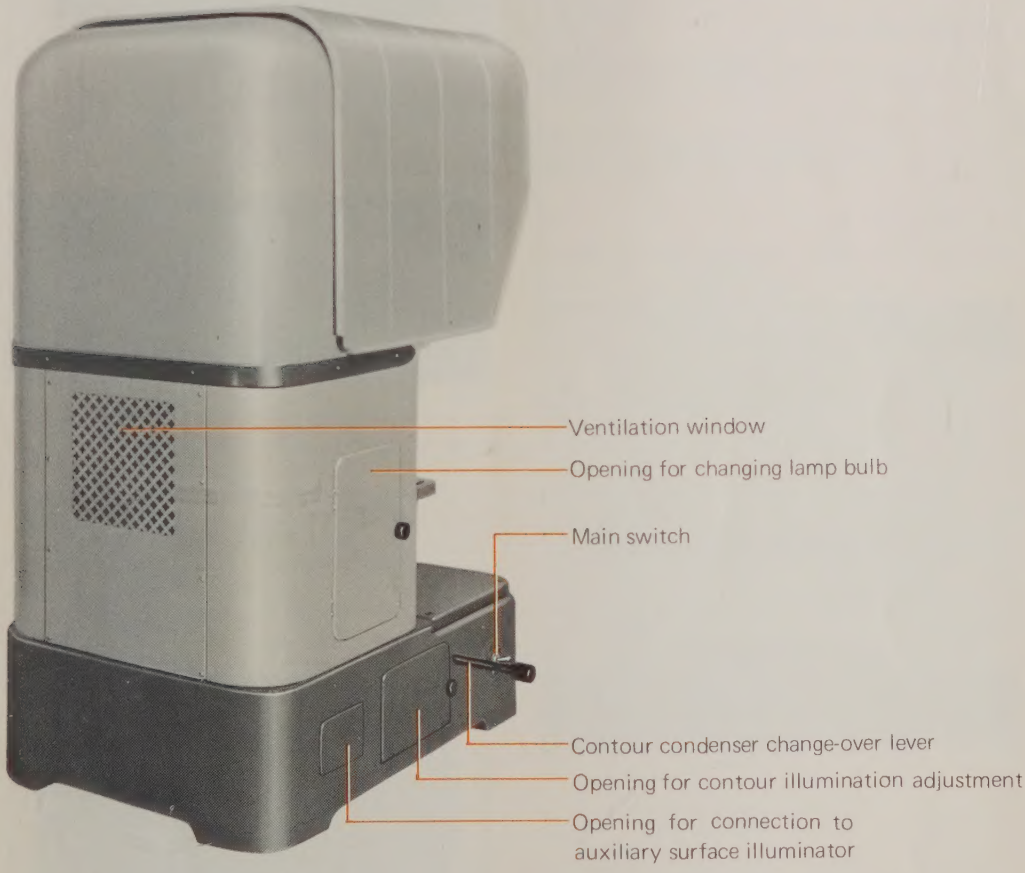
■ Available in two models — 6CS (with a single mount) and 6CT (with a turret mount). These two types have specifications in common except lens mount fitting. This instruction manual uses the picture of Model 6CS for explanation.

NOMENCLATURE

Front View



Rear View


Ventilation window
Opening for changing lamp bulb
Main switch
Contour condenser change-over lever
Opening for contour illumination adjustment
Opening for connection to auxiliary surface illuminator

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PARTS OF PROFILE PROJECTOR MODEL 6C

1. Viewing screen (Fig. 4)

Four chart clips and the glass reading scale furnished as an accessory can be attached to the screen rim.
The screen is interchangeable either with the rotatable protractor screen or the photographing screen.

2. Screen lock (Fig. 5, 6)

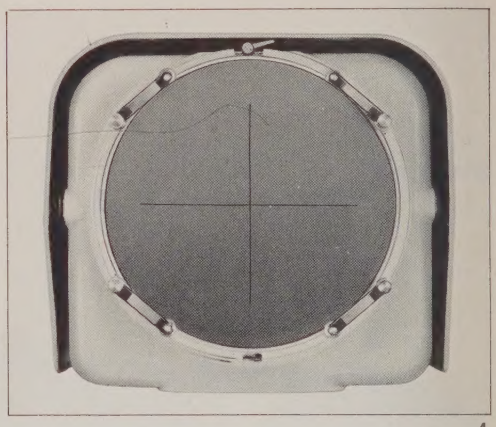
To remove the screen from the instrument, release the lock lever (Fig. 5) on top of the screen rim by turning counterclockwise.

3. Chart clips (Fig. 7)

The clips serve for holding a sheet of paper or plastic on the screen which may be used as a master chart.
The chart clips can be detached from the screen rim by unscrewing their milled rings.

4. Hood (Fig. 7)

When extraneous light makes the viewing of the screen image difficult, pull forward the screen hood. It can be pushed backward when unnecessary.



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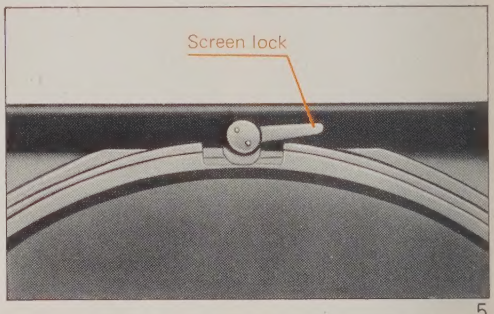

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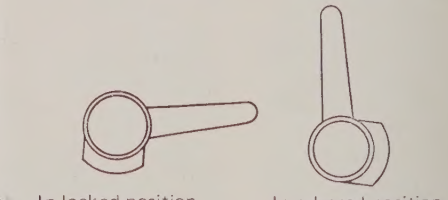

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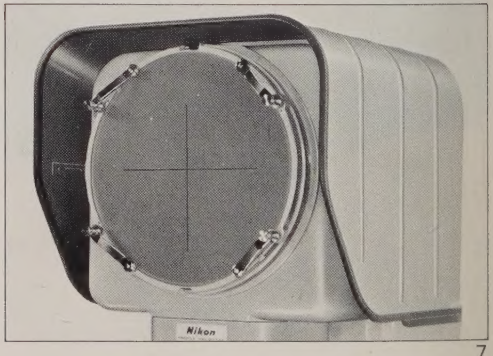

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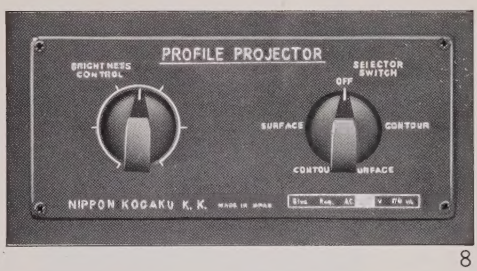
5. Selector switch (Fig. 8, 9)

There are two switches on the front panel of the instrument. The right one is the selector switch for turning on and off the contour or surface light. The electric fan motor starts running automatically the moment the switch is on and stops when it is off. Manipulate this switch at all times after the main switch has been turned on.



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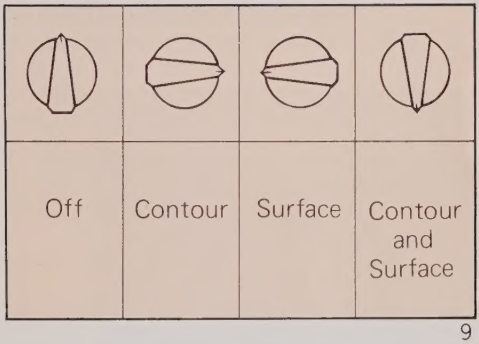
6. Brightness control switch (Fig. 8)

The left-hand switch controls brightness of the contour light, increasing it when turned clockwise and decreasing it when turned counterclockwise.

For general use, setting one step before the brightest position is recommended in view of balancing the brightness and the life of the lamp bulb.



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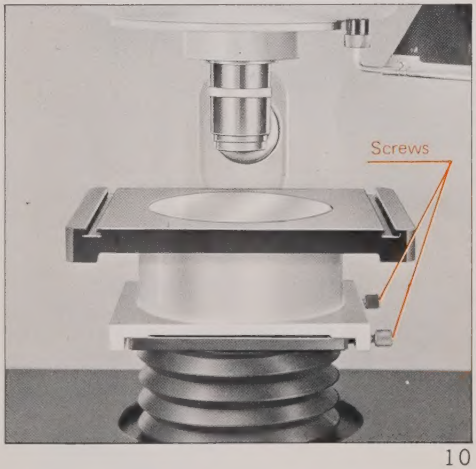
7. Main switch (Fig. 3)

When the instrument is not in use, be sure to keep it at "off" position.

8. Stage Mount (Fig. 10)

This mount accepts interchangeably the stages of various types. (P. 18) After releasing the two milled screw heads on the right side of the stage, place the stage gently on the mount. Then, by fastening or releasing the milled screw hands, move the stage back and forth around the inside projection on the left-hand center, so that the position of the stage is precisely adjusted in respect to the crossed lines engraved on the screen glass.

In detaching the stage, take special caution in handling not to destroy its high accuracy.



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9. Focusing wheel (Fig. 11)

Turning of the focusing wheel on the right side of the instrument moves the stage up and down (2mm by every full rotation). Turn the wheel carefully when the movement of the stage comes near its upper or lower limit to avoid damaging the stoppers.

10. Projection lens (Fig. 10)

To dismount the lens, while depressing lightly the spring catch on the right side of the lens mount, turn the lens clockwise (seen from above) until the red dot on the lens barrel meets the red dot on the lens mount.

To mount the lens, line up the red dots on the lens and the mount, and place the lens over the mount. Turn the lens counter-clockwise until it clicks into position.

Facing to the front of the magnification figure engraved on each lens is an indication that the lens has been correctly mounted.

Keep in mind to hold the upper milled ring part of the lens when you handle it.

11. Surface illuminator (Fig. 2)

For surface (reflecting) illumination, the half-reflecting or full-reflecting mirror is to be attached to the projection lens, depending upon whether vertical or oblique illumination is desired.

Light coming from the built-in surface illuminator is reflected on the mirror and illuminates the surface of specimen.

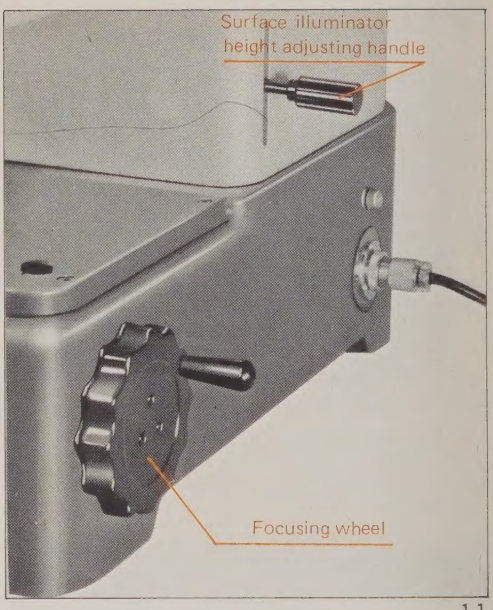
Turning of the black-finished milled ring will move the condenser back and forth and varies the convergence of the illuminating light.

12. Surface illuminator height adjusting handle (Fig. 11)

The surface illuminator is moved vertically by raising and lowering the handle on the right side of the instrument, after releasing it by a slight counterclockwise rotation.

Lock the handle at the desired position by rotating it clockwise.

To exchange the bulb, the handle must be fixed at the topmost position.



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13. Anti-glare filter (Fig. 12)

This plate which intercepts strong light that may cause dazzle turns around the vertical and horizontal axes and stops at any position. To detach the plate from the instrument, unscrew the black knurled part found at the base of the holder.

14. Opening for changing lamp bulb (Fig. 3)

To change or adjust the light sources, open the door by turning the black-colored screw counterclockwise and reach the inside lamp bulbs. A circuit diagram is attached to the back of this door. Oil the fan motor a couple of times a month.

15. Opening for contour illumination adjustment (Fig. 13)

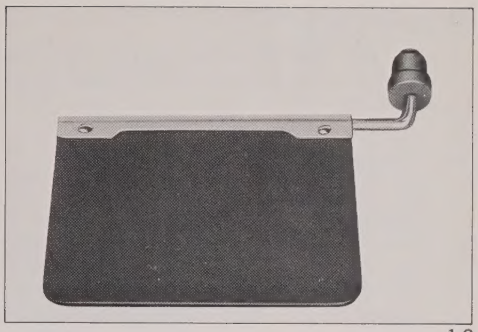
The door being opened, adjustment of the condensers and lamp bulb is conveniently performed.

16. Contour condenser change-over lever (Fig. 13, 14)

As the lever is linked to the slider (Fig. 14) on which condensers are mounted, changing over of the condensers is made by drawing in and out the lever, according to the magnification of the projection lens being used. The condenser A is for 10x, B for 20x—100x and D for 50x—100x. (See P. 10 Fig. 19)
The lever click-stops at the indications 10x, 20x and 50x. You can therefore select whicheyer one of the condensers.

17. Power socket (Fig. 15)

Insert the electric cord plug into the socket and fasten the nut around the plug. To detach the cord, unscrew the nut and then pull out the cord. Bear in mind to shut off the electricity beforehand.



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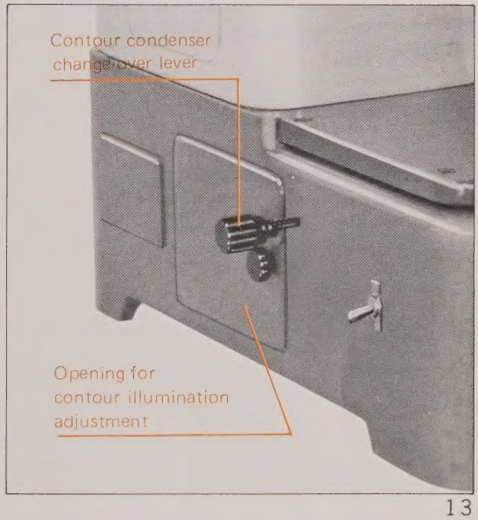

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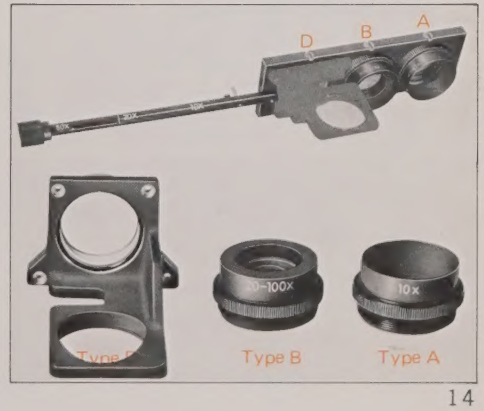

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18. Fuse (Fig. 15)

Unscrew the fuse holder by turning in the direction of the arrow, and the fuse will be exposed.

19. Ventilation window (Fig. 3)

Do not place anything close to the rear window of the instrument, because it prevents warmed inside air from flowing out through the window. For the same reason, the instrument should not be placed with its back pushed direct against the wall.

20. Auxiliary surface illuminator attaching hole (Fig. 16)

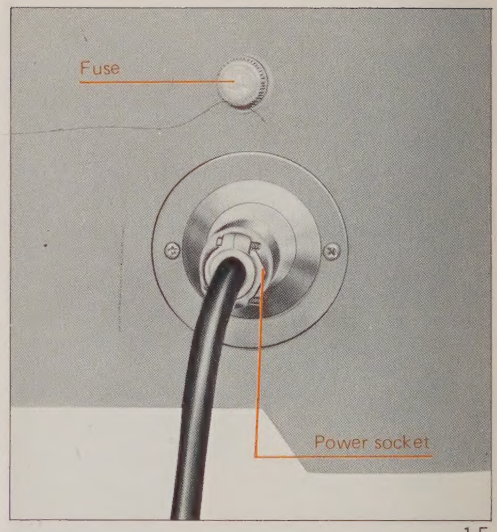
Remove the screen and release the inside nut. After the bolt has been unscrewed, the auxiliary surface illuminator, available as an accessory, can be attached. This projector is provided with a mounting hole for the dial indicator holder which consists of a bushing angle, an arm and a clamp to hold the indicator.

21. Side plate attaching screw hole (Fig. 2)

Unscrew the black-colored knurled screw. Then the side plate, available as an accessory, can be attached to the instrument. This side plate may conveniently be used to take note of measuring results, etc.

22. Opening for connection to auxiliary surface illuminator (Fig. 3)

Additional surface illuminator is to be connected to its panel (with a switch and socket) which is to be replaced for the terminals found inside the lid on the left side of the instrument (Fig. 3). The connection should be made as shown in the illustration (Fig. 17), the cords being connected to the same colored terminals.



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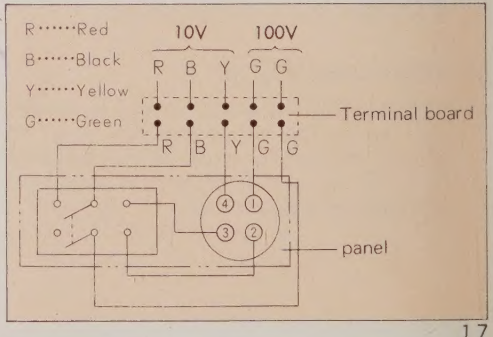

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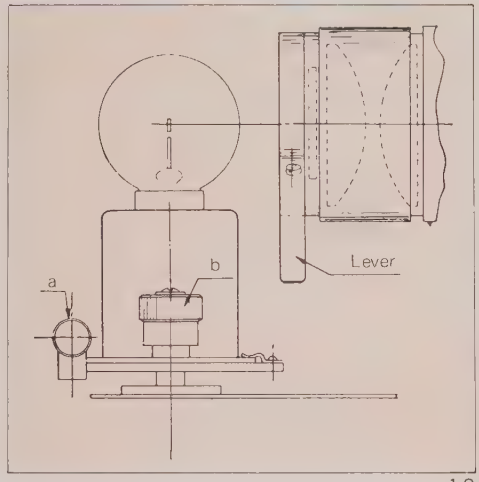
USING

(1) Illumination

There are two different illumination systems; contour and surface. Contour illumination is used for producing magnified silhouette (shadow) images of specimens to be inspected or measured. Surface illumination is used for producing magnified surface images of such opaque specimens as are difficult to inspect in details with the contour illumination.

A. Contour Illumination

The lamp for contour illumination will be lighted if the right-hand knob or the front panel of the instrument is turned to the position "Contour" (Fig. 9). Then adjust the illumination with regard to the following tow matters.



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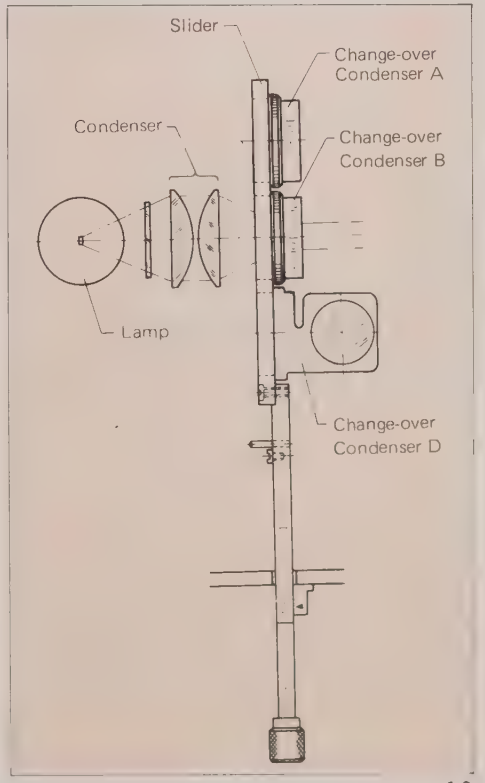
1. Telecentric illumination

First mount the detecting lens marked "Detect" onto the lens mount of the instrument in place of one of the projection lenses. A sharp image of the lamp filament obtained at the center of the screen indicates that the correct telecentric illumination is attained, which is essential for accurate measurement. If the filament image does not appear sharp or is not at the center of the screen, adjustment proceeds as follows: Open the lower opening door (Fig. 3). Back and forth movement of the lamp bulb is made by swinging the inside condenser lever (Fig. 18), right and left movement by turning a screw **a** (Fig. 18) and vertical movement by means of another screw **b** (Fig. 18).
Mounting or dismounting of the detecting lens is the same as that of the projection lens (see P. 7).

2. Change-over condensers

The projection lens to be used is mounted on the instrument by bayonet fashion. Check whether the change-over condenser inside the instrument suits the magnification of the projection lens being used. For this purpose, open the lower opening door. You will find the black-finished condenser change-over slider (Fig. 19). Slide it in or out.



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B. Surface Illumination

In this type of illumination, light is supplied by the built-in surface illuminator incorporating a lamp, condensers and heat absorbing filter. There are two ways of giving surface illumination; vertical and oblique.

1. Vertical illumination (Fig. 20)

This is performed by throwing light horizontally upon the 45° inclined half-reflecting mirror (Fig. 1) attached on the projection lens. By this the specimen surface is illuminated vertically from above.

This type of illumination is, from the nature of its arrangement, better suited for examination of smooth or polished surfaces.

The half-reflecting mirrors are supplied with 10x, 20x and 50x projection lenses.

2. Oblique illumination (Fig. 21)

This illumination is preferably applied to examine an uneven, light scattering surface such as of textile, etc., as it will present an image in better relief.

The full-reflecting mirror is supplied with 10x and 20x projection lenses.

3. Surface illuminator

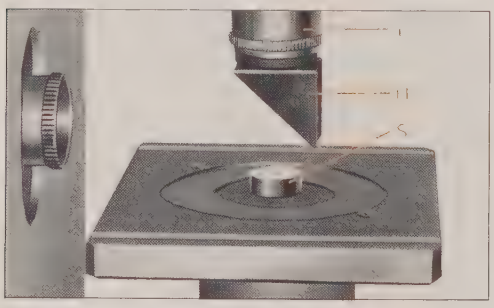
Light for surface illumination is turned on when the right-hand knob on the front panel of the instrument is set at the position "Surface" (Fig. 9).

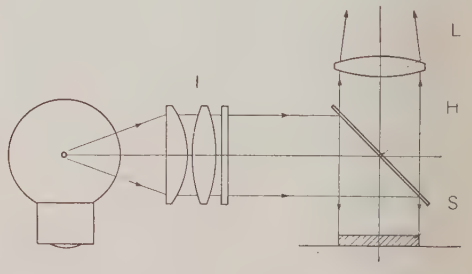
The half-reflecting or full-reflecting mirror attached to the projection lens is to be adjusted in the following manner:

a) Face the reflecting surface of the mirror exactly toward the surface illuminator.

b) Move the illuminator up and down by means of the height adjusting handle on the right side of the instrument so that the center of the mirror is on the same level with the optical axis of the illuminator.

c) The whole area of the mirror surface should be illuminated without any loss of light. Change the convergence of light by screwing in or out the black-finished milled ring.





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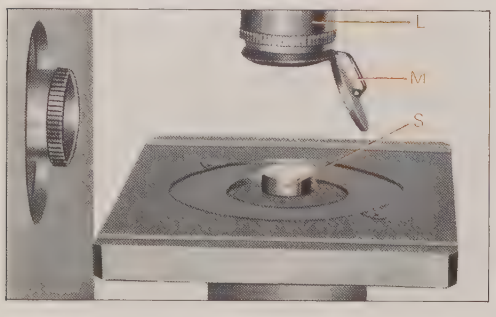

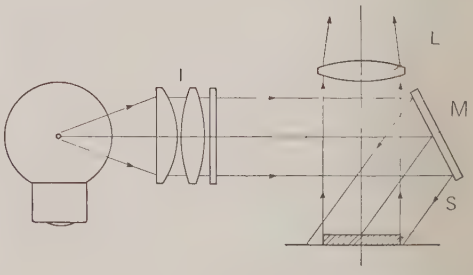

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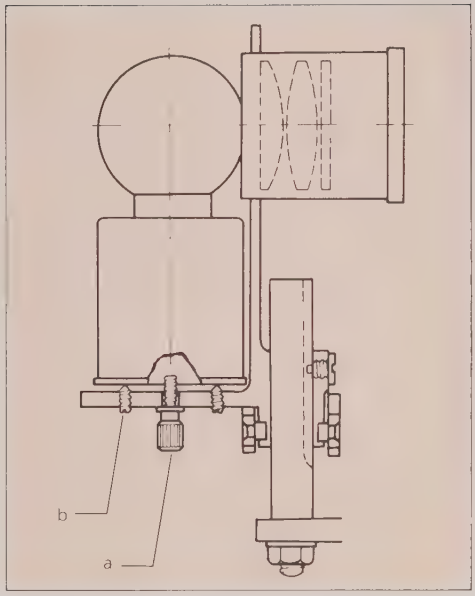
I = Illuminator L = Projection lens H = Half-reflecting mirror
M = Full-reflecting mirror S = Specimen

In case, sufficient illumination cannot be obtained by the above methods, adjust the lamp bulb so that it is exactly brought to the axis of the condenser lens by adjusting screws.
By releasing the two knurled screws **a**, bulb is moved right and left, and by the three screws **b** around the lamp socket, it is moved up and down (Fig. 22).



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(2) Projection

In projecting image on the screen, the following points should especially be considered:

1. Fixing of specimen on the stage.
2. Sharp focusing of image.
3. Bringing the portion of the image to be inspected to the correct position.

1. Fixing of specimen

The surface of section of the specimen to be projected should be placed to the right angle to the optical axis of the lens. In case the specimen has a flat surface parallel to the bottom, place simply the specimen on the stage without any fixture. However, if the specimen happens to be of cylindrical form, such as pin, shaft, thread screw, tap, etc., the use of a V-block support or a tilting center fixture will be necessary to avoid rolling on the stage.

2. Sharp focusing

Focusing is performed by raising and lowering the stage by means of the focusing wheel located on the right side of the instrument.
Sharpness over the whole area of the screen image is obtained by maintaining squareness of the outer or sectional surface of the specimen to the optical axis of the projection lens. Otherwise, inaccuracy in the measurement will result due to magnification error. This error may become more striking in the surface illumination.
Follow the procedure given below in order not to thrust the specimen, while focusing, against the lens front, half-reflecting or full-reflecting mirror:
First raise the stage as far as the clearance between specimen and projection lens becomes less than the working distance of each lens indicated on the table (P. 17 Table 1), then looking at the screen image, lower the stage slowly until the specimen image is plainly sharp.

3. Correct positioning

The image of the portion to be examined can easily be brought by hand to the desirable position at low magnification. However, at high magnification, the normal fixed stage should be replaced by the cross-travelling stage or the micrometer stage, both available as accessory. In this case positioning may proceed as follows:
First use a lower magnification lens to bring the image of the portion to be examined to the center of the screen. Then lower the stage to the lowest limit by rotating the focusing wheel, so as not to thrust the lens against the specimen, and then change over to a higher magnification lens. If a lot of specimens of the same size and shape are to be successively examined, the use of a fixture, specifically designed to hold the specimen, is advantageous, for which purpose the stage is equipped with T or dovetail slots.

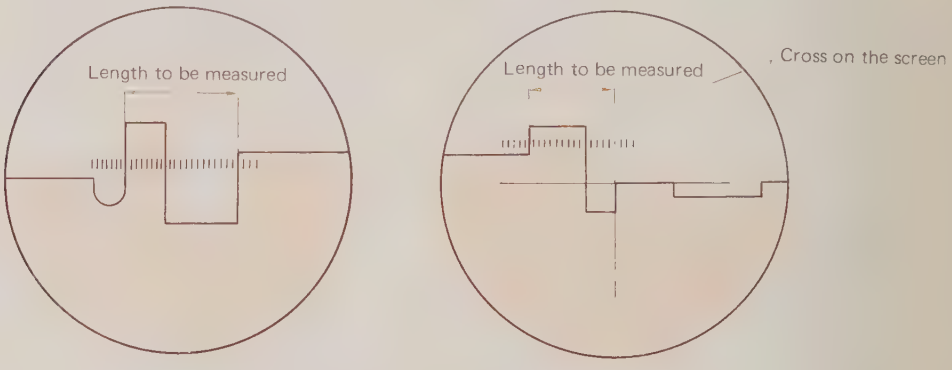
(3) Measurement

The method for measuring should be varied according to the size, shape, quantity and position of the specimen to be measured and the accuracy of measurement required. Here are a few examples of the basic method for measuring.

1. By placing a scale on the screen

Dimensions of screen image can be measured with a scale placed on the screen.

In this case, the use of a high power magnifying glass is not necessarily recommended, for the conspicuous ground glass grains on the screen surface may hinder the clear cut image contours, and what is more, it will cause eyestrain on the part of the operator, especially in a prolonged observation. It is advisable to use the glass reading scale (0.5 mm or 0.1 mm), furnished as an accessory, since it has graduated surface which can be brought in close contact with the image, thus eliminating any inaccuracy due to parallax (Fig. 23).



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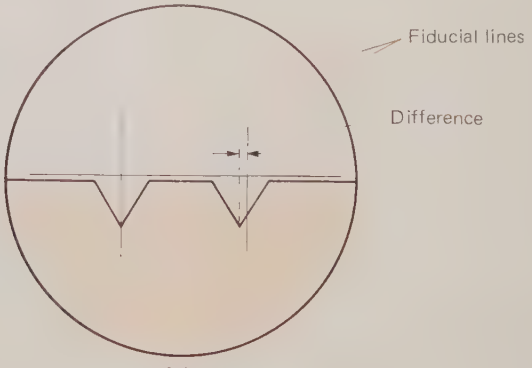
2. By comparison with standard length

When inspections are to be repeated for a lot of specimens, it is recommended to draw two lines on the screen glass with an interval corresponding to the standard length (Fig. 24).
Measure the difference of the image length against the standard length by means of a scale or more easily by use of the micrometer screw provided on the micrometer stage furnished as an accessory.



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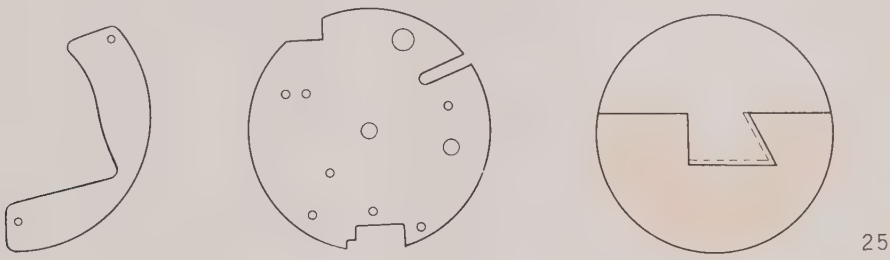
3. By comparison with master chart

Inspection of a complicated shape of specimen (Fig. 25) can easily and rapidly be made by overlapping the image with the master chart which can be held on the screen by means of the chart clips or some adhesive. Needless to say that the chart should be drawn at the same magnification rate as that of the projection lens in use.

For master charts, translucent paper or plastic sheet will be used. However, if more accurate work is required, paper adhered to transparent glass plate is recommended, which can be brought into close contact with the screen surface only by using the chart clips.

Plastic sheet can be handled more conveniently than glass, because of its light weight and unbreakable property. But it is more liable to be scratched and has greater thermal expansion and undergoes some dimensional change by age.



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4. By tracing

This can simply be done by tracing the projected image on tracing paper or any other transparent sheet (e.g. celluloid, plastic, etc.). To prevent the sheet from shifting, press corners with "Scotch tape" or some other adhesive. The traced image of a specimen can be used as a master chart on which the images of other specimens to be checked are projected one after another on the screen and overlapped for comparison.

If necessary, it is possible to keep the traced image for the future use.

However, note that the paper, being subjected to be broken, expanded or shrinked, is not suitable for use in accurate comparing for a long time. From this point of view plastic is preferable. It is advisable not to attach paper onto the plastic sheet, but to use the plastic sheet with a mat side on which fiducial lines or figures are to be scratched directly. When tracing sheet has been removed, wipe off completely the adhesive from the surface of the screen using gasoline.

5. By photographing screen image

Photographing is serviceable when it is necessary to examine the image later or to keep a record of it for long.

Exposure time varies considerably according to the material or surface condition of the specimen, the lens magnification, type of illumination, voltage of the light bulb, etc.

The surest way to determine the correct exposure time is to expose a test plate in steps of various time and select the time giving the best result.

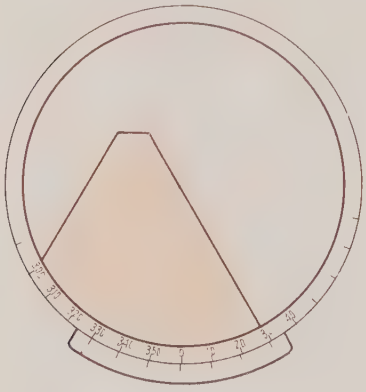
In the correct exposure determining process, it is better to put forth and aside a piece of cardboard right under the projection lens than to resort to the switching off-and-on of the light bulb.

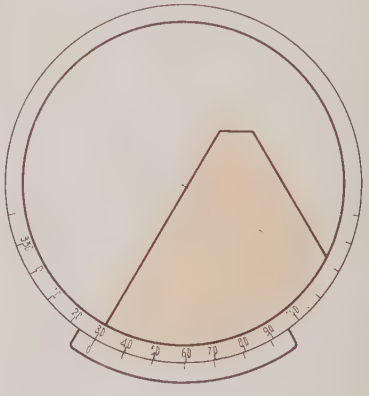
It is advisable to use photographing plate in preference to bromide paper which is subject to expansion and shrinkage.

6. Measuring angle by rotating the screen (Fig. 26)

The angle can be measured also by using the rotatable protractor screen which is available as accessory. First, bring one of the crossed lines engraved on the screen into coincidence with a side of the angle to be measured, the apex being in contact with the center of the crossed line, and take angle reading on the protractor. Then, by rotating the screen, bring the same crossed line up to the other side of the angle and read the protractor. The difference between the two readings will give the angle to be measured. In measuring a fairly large angle, it may be efficient to take the difference against the right angle of the crossed lines.

More rapid and convenient angle measurement will be performed by using the micrometer stage or the cross-traveling stage, in which it is unnecessary to make the center of the crossed lines coincide with the apex of the angle to be measured. It is noteworthy that, in bringing a side of the angle to the crossed lines, a better result will be obtained, if a slight clearance is made therebetween, by which the coincidence error may be avoided.





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CAUTION AND MAINTENANCE

1. Aperture diaphragm

When objects with uneven surfaces are observed by oblique illumination, the use of the aperture diaphragm is recommended, as a more depth of focus will be obtained.
In photography, the darkness of the image caused by such a diaphragm, can be compensated by elongating the exposure time.
It is advantageous to reduce the depth of focus, however, when measuring an exact size of the projected image, because a shallower depth will enable determining more easily which part of the image is at the correct magnification. Two types f/8 and f/5.6 of the aperture diaphragms are available for the 10x and 20x projection lenses respectively.

2. Mirrors

Two kinds of full-reflecting mirrors (back-side and surface mirrors) are used.
The full-reflecting mirrors to be attached on the projection lenses for oblique illumination and the built-in mirror located under the stage used for contour illumination belong to the back-side mirrors. The larger mirrors built inside the instrument above the projection lens and behind the viewing screen are aluminum-plated surface mirrors. To clean the back-side mirror, first remove dust with a feather and then use soft washed-out linen soaked with alcohol. The surface mirrors are liable to be rubbed off, so keep fingers off their surfaces. If need arises to take any dirt off their surfaces, contact the maker or his agent.
The 45° half-reflecting mirror to be used for vertical illumination is coated with the extremely thin layer of nonmetal. Therefore, take care not to touch the surface or rub it. Little dust present on the mirror will not affect image quality. To take dirt off its surface, use soft feather. If not sufficient, use a wad of cotton soaked with ether and sweep over it carefully. Don't rub it.

3. Dark image

If the screen image is too dark, take out the lamp bulb and check it. If the glass surface of the lamp bulb is blackened, change the bulb with a new one.
Check occasionally the surfaces of the mirror found just under the stage and also of the condenser. Wipe off the dust on them with a soft feather, for they are liable to gather dust swirled up by the cooling fan.

4. Lamp bulbs

If the lamp should fail, check the lamp filament, and the fuse. Insufficient contact of the cord plug or of the socket may sometimes cause failing of the lamp. In changing the bulb, take care of the correct direction in which it is to be attached to the socket by bayonet fashion.

5. Screen glass

If the screen glass is smeared with oil, grease, dirt, etc., image will not clearly be seen. For cleaning, remove the screen glass together with its frame (not the glass independently) and use warm water and soap. Mount it again after being dried.

Important!

The cooling fan is to be oiled occasionally.
The two inside mirrors should by no means be adjusted.
Each lens system should never be dismantled.
If anything wrong is found, contact the maker or his agent.

TECHNICAL DATA

Screens

Effective diameter of screen: 12" (300mm)
Provided with crossed lines engraved. Equipped with 4 detachable chart clips.
Glass Reading Scale, available as special accessory, can be attached.
Interchangeable with Rotatable Protractor Screen of Photographing Screen.

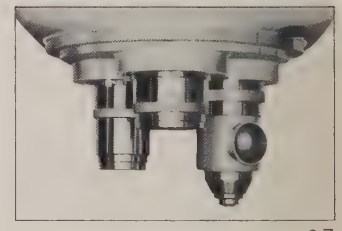
Projection lenses **Table 1**

Magnification	Diameter of object field inch (mm)	Working distance inch (mm) A	B	C	Half-reflecting mirror (for vertical illumination)	Remarks
10×	1.2 (30)	2.4 (60)	0.68 (17)	0.72 (18)	Attachable	With mirror With f/5.6 and f/8 diaphragms
20×	0.6 (15)	1.28 (32)	0.28 (7)	0.4 (10)	〃	〃
31.25×	0.384 (9.6)	0.8 (20)	0.8 (20)	—	Built-in	——
50×	0.24 (6)	0.48 (12)	0.48 (12)	—	〃	Spring-loaded
62.5×	0.192 (4.8)	0.36 (9)	0.36 (9)	—	〃	〃
100×	0.12 (3)	0.2 (5)	0.2 (5)	—	〃	〃
200×	0.06 (1.5)	0.32 (8)	0.32 (8)	—	〃	Long working distance type
300×	0.04 (1)	0.32 (8)	0.32 (8)	—	〃	〃
400×	0.03 (0.75)	0.2 (5)	0.2 (5)	—	〃	〃
500×	0.024 (0.6)	0.2 (5)	0.2 (5)	—	〃	〃

A: Contour illumination B: Vertical illumination C: Oblique illumination
* Auxiliary surface illuminator permits oblique illumination for all magnifications, as reflecting mirror is unnecessary.

Lens mount

Model 6CS: With a single bayonet mount for each projection lens.
Model 6CT: With a three lens turret mount (Fig. 27) for rapid and convenient interchange of the projection lenses.



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Stage

Table 2

Type	L	S	A2	E2	O
Size of stage surface Longit. X Lateral	6.4″×8″ (160× 200 mm)	6.4″×8″ (160× 200 mm)	6.4″ in dia. (160 mm ″)	6″ in dia. (150 mm ″)	6″×11″ (150×280mm)
Cross travel Longit. X Lateral	—	—	1″×2″ (25×50mm)	1″×1″ (25×25 mm)	2″×4″ (50×100mm)
Minimum reading	—	—	0.001 mm	0.001 mm	0.001 mm
Throat clearance	0—2″ (0—50 mm)	1.6″ 3.6″ (40— 90 mm)	0—1.8″ (0—46 mm)	0—1.8″ (0—46 mm)	0—1.6″ (0—46 mm)
Remarks	With T groove	With T groove	With 2′ reading revolving stage. With T groove. Range of zero-resetting: 0.1″ With block gages	With 2′ reading revolving stage. With T groove. Range of zero-resetting: 0.1″	With dovetail groove. Range of zero-resetting: 0.1″ With block gages

Illumination

Contour illumination

Permits telecentric illumination (with detecting lens)
Provided with a heat absorbing filter.
Use either of the condensers (for 10x, 20x—100x and 50x—100x available as special accessories), according to the magnification of the projection lens being used.

Surface illumination

Permits vertical and oblique illuminations for 10x and 20x, using reflecting mirror.
Surface illuminator is built-in.
Provided with a heat absorbing filter and attachable anti-glare filter.

Light source

10V, 70W with specified filament.
Same type bulb is used for contour and surface illuminations.
Brightness is variable for contour illumination.

Ventilation equipment

Fan motor, 100V 9W, is built-in

Electrical requirement

Built-in transformer

Primary current:	A C 100V
Single phase:	50—60 Hz
Capacity:	150 V A

Accuracy of magnification

Within ±0.1% of nominal value of each projection lens.
Within ±0.15% when used with half-reflecting mirror.
These accuracies are guaranteed for projection lenses delivered with instrument body.

Dimensions

Height:	Approx. 2.5′ (88 cm)
Width:	Approx. 2′ (62 cm)
Depth:	Approx. 2.4′ (74 cm)
Floor area:	Approx. 1.3′ (40 cm) wide X 1.8′ (56cm) deep

Weight

Instrument with projection lens 10 x and condenser: Approx. 133 lbs. (60 kg)
With pedestal: Approx. 195 lbs. (88 kg)

MP MASTER
MA29620

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